Information Communication Technology (ICT) Infrastructure and Electronic Examination in Joint Admissions and Matriculation Board (JAMB)

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Abstract
The relevance of Information Communication Technology (ICT) in the conduct of business-both in Government and the Private worlds cannot be overemphasized. While in the advance countries adequate provision is made for ICT Infrastructure to forestall break down of transactions and to reasonably keep hackers at bare, such efforts are not consciously made in developing countries. This Paper assesses ICT infrastructure and electronic Examination in Joint Admissions and matriculations Board with a view to evaluating the e- readiness of JAMB in the conduct of its Computer Based Test (CBT). To realize this goal, data for the study was obtained using the questionnaire which was administered to the staff of JAMB Headquarters Bwari-Abuja, as well as undergraduates from the University of Abuja, and students of College of Education Zuba and Dorben and Polytechnic Bwari. The analysis of data and test of hypothesis was done with the aid of SPSS. The study found out that JAMB has significant ICT to conduct her electronic Examination. The study concludes that, JAMB Computer Based Test has come to stay; hence more efforts are now required to strengthen the existing JAMB's ICT for improved performance. As a fall out of this finding, this paper recommends the development of ICT infrastructure to cover all nooks and crannies of the country, and creation of more centres.

Keywords: Information Communication Technology, Infrastructure, Electronic Examination

I. INTRODUCTION

Information and Communication Technology (ICT) focuses specifically on the application of these new technologies in an educational context and environment, and serves as a tool for supporting the various components of education. Such components include, among others, teaching and learning, resources management (human, material, financial resources) and admission and examination processes also known as learning assessment, test and measurement. One specific form of ICT for assessment is the Computer-Based Testing (CBT), also known as Computer-Based Assessment or e-assessment/testing. It is a method of administering tests in which the responses are electronically recorded, assessed, or both. It is commonly available for several admissions tests throughout the developed countries and developing countries are adopting it too.

Computer-based tests offer several benefits over traditional paper-and-pencil or paper-based tests. Technology based assessment provides opportunities to measure complex form of knowledge and reasoning that is not possible to engage and assess through traditional methods (Bodmann and Robinson, 2004). Consequently, in Nigeria, employers now conduct aptitude test for job seekers through electronic `means; the universities and other tertiary institutions are registering and conducting electronic examination for their students through the internet and other electronic and networking gadgets. Similarly, different examination bodies in the country such as West Africa Examination Council (WAEC), National Examinations Council (NECO), National Business and Technical Examination Board (NABTEB), and National Teachers' Institute (NTI), among others register their students through electronic means (Olawale and Shafii, 2010). Computer and related technologies provide powerful tools to meet the new challenges of designing and implementing assessments methods that go beyond the conventional practices and facilitate to record a broader repertoire of cognitive skills and knowledge (Mubashrah, Tariq and Shami, 2012).

In Nigeria, the mandate to conduct entrance examination into tertiary educational institutions (Universities, Polytechnics, Colleges of Education & related/similar institutions) is vested in a body called Joint Admissions and Matriculation Board (JAMB). Thus, every year, JAMB conducts Unified Tertiary Matriculations Examination (UTME) and forwards the results to the candidates' institutions of choice for selection and admission. Over the years, the UTME by JAMB has been a paper and pencil test (PPT) form, and has been characterized by a lot of fraudulent practices ranging from leakage of examination papers, use of machineries of all sorts by candidates, bribe taking by examination officials,

impersonation, use of unauthorized gadgets, and so on (Osuji, 2012).

In order to eliminate or minimize incidence of the vices, and/or other reasons, JAMB in 2013 introduced the computer based testing (CBT) form of UTME and gave massive publicity and sensitization on it. JAMB gave the advantages of CBT to include increased delivery of test items that have been calibrated and delineated according to their pertinent item characteristics: instructional level objectives, difficulty level, discrimination level and functionality of distracters, efficient administration of examination and scoring of tests, reduced costs for many elements of the testing lifestyle and logistics, improved test security resulting from electronic transmission and encryption for total eradication of breaches of examination security, unbiased test administration, reduction in the spate of examination security breaches, and improvement in the quality and standard of education in the long run.

II. STATEMENT OF THE PROBLEM

While the introduction of CBT is considered a laudable initiative, the experience has proven in some areas to have lacked the infrastructure to conveniently and effectively operate. There have been issues associated with inadequate CBT centres, inadequate computers, and inadequate internet services among others. It is out of these concerns that this study examined ICT infrastructure and electronic examination in JAMB.

III. PURPOSE OF THE STUDY

This paper examines of ICT infrastructure on electronic examination in JAMB. The sole objective is therefore to find out how ICT infrastructure in Nigeria has assisted JAMB in the conduct of electronic examination for entry into tertiary institutions in Nigeria.

IV. HYPOTHESIS OF THE STUDY

H_0: There is no significant difference between adequacy of ICT infrastructures, and effective electronic examinations.

Ha: There is significant difference between adequacy of ICT infrastructures, and effective electronic examinations

V. SCOPE OF THE STUDY

This study centers on ICT infrastructure and electronic examination in JAMB with a view to assessing the extent to which the availability of ICT infrastructure has hampered or aided the conduct of electronic examination by JAMB. The study is therefore restricted to the period of 2013 to 2019. The choice of this period is to examine electronic examination in JAMB since its inception up to date.

VI. CONCEPTUAL AND THEORETICAL ISSUES

Information Communication Technologies (ICTs)

All over the world, information Technology (IT) has become the digital nervous system of organisations. Management information systems (MIS) are fundamental for public sector organisations seeking to support the work of managers. Information technology is perceived as an instrument for engendering competitive advantage in organisations as it promotes greater efficiency and effectiveness in operations. The importance of Information technology in enabling organisations to develop more effective and efficient operational and management processes has been spelt out by Frenzel (1996).

According to Mejabi (2008), information and communication technology is a general term that describes any technology that helps to produce, manipulate, store, communicate and/or disseminate information. Microsoft Encarta 2009 defined information and communication technology as the processing of data via computer: the use of technologies from computing, electronics, and telecommunications to process and distribute information in digital and other forms.

Information technology combines the technology of computers and communications to provide information processing services throughout the office or around the world. Sajuyigbe and Alabi, (2012) posited that ICTs encompass technologies that can process different kinds of information (audio, video, text, and data), and facilitate different forms of communications among human agents, and among information systems.

Information Technology (IT) is the automation of processes, controls, and information production using computers, telecommunications, software and ancillary equipment such as automated teller machine and debit cards (Khalifa 2000). It is a term that generally covers the harnessing of electronic technology for the information needs of a business at all levels. Communication Technology deals with the physical devices and software that link various computer hardware components and transfer data from one physical location to another (Laudon and Laudon; 2001).

Information and Communication Technologies (ICTs) may be viewed in different ways. The World Bank defines ICTs as “the set of activities which facilitate by electronic means the processing, transmission and display of information” (Alu, 2002). ICTs can be described as a complex varied set of goods, applications and services used for producing, distributing, processing, transforming information (including) telecoms, TV and radio broadcasting, hardware and software, computer services and electronic media” (Laudon and Laudon 2010). ICTs

represent a cluster of associated technologies defined by their functional usage in information access and communication of which one embodiment is the Internet.

Thong and Yap (1995) observed that information technology was defined as computer software and hardware solutions that provide support of management, operations, and strategists in organizations. Thong and Yap (1995) states that the goal of having Information Technology (with all computer applications like MRP/EDI, CAM/CAD) is to increase productivity of corporations. Boar (1997) defines information technology as "those technologies engaged in the operation, collection, transport, retrieving, storage, access presentation, and transformation of information in all its forms..." Also, information technology could be regard as technological aspect of systems of information as it is reported by Hollander et al (1999).

Sarosa and Zowghi (2003) on information technology in Indonesia, information technology was explained as "all the technology that is used by an organization to collect, process, and disseminate information in all its form. Therefore, the component of information technology will include hardware (scanner, printer, computer, etc), software (operating systems, application development language, office application, etc.). According to Attaran, (2003), information technology is defined as capabilities offered to organizations by computers, software applications, and telecommunications to deliver data, information, and knowledge to individuals and processes.

The application of CBT in learning assessment has gone a long way to tackle examination fraud. The former Vice Chancellor of Rivers State University of Science and Technology, Professor Barineme Beke Fakae in an International Technology Exhibition in Dubai, the United Arab Emirate, stated that ICT breaks wings of corruption. He asserts that prospective students are admitted on merit bases and that the institutions data base is matched with that of JAMB (Vanguard, 2014). This means fraudulent activities as impersonating can be easily dictated as exchange of information between the institution and JAMB is via biometrics and physical data. The Joint Admissions and Matriculation Board (JAMB) concluded its first solely Computer-Based Test (CBT) after its introduction in 2013. The examination, which commenced March, 9th 2015 in 400 centres across Nigeria and seven other countries, has elicited sundry reactions from candidates and other stakeholders. While some candidates applauded the conduct of the computer-based test and the swiftness in releasing the results, others have highlighted its many lapses. Notable among the CBT's shortcomings are the server and power failures experienced in some centres, as well as non-availability of other sources of power supply. There were also cases of outright change of examination dates without notification to the affected candidates.

Particularly, in Rivers state the above-mentioned lapses were recorded as it was reported that candidates went on rampage after several failed attempt to obtain their accreditation papers (Tide, 2015). Another challenging factor was the large number of candidates to limited approved centres for the test as asserted by the Zonal Coordinator, JAMB, Rivers State, Mrs Beatrice Etta-Nyiam. She stated that the approved CBT centres include Rivers State University of Science and Technology (RSUST), University of Port Harcourt (UNIPORT), Rivers State Polytechnic (Rivpoly), Federal College of Education, Technical, Omoku, Ignatius Ajuru University of Education (IAUOC), Rivers State College of Arts and Science and two others (Tide, 2015). Rivers state with a large number of candidates across the 23 LGAs had only 8 approved centres. The upshots of JAMB CBT and candidates' experiences across the country are similar in nature but that is not to say that certain states did not record peculiar accounts like the physical confrontation exhibited by candidates in Rivers State. It was against these backdrops that this study was carried out to determine readiness and acceptability levels of Rivers State secondary school students in application of this innovative form of examination in further assessment (Post-UME). However, observable merits of the new testing technique include the elimination of impersonation, special centres and cheating. The method also ensured the release of results few hours after the examination (Sun, 2015).

VII. ELECTRONICS EXAMINATIONS (E-EXAMINATIONS)

Online examinations which are a variant of a CBTS can be used as an assessment-evaluation tool in distance education systems that have quite a number of students. For such systems, good execution of examination aimed at assessment and evaluation is very critical because problems arising from human-centered errors or technical difficulties may lead to questioning of the examination, and thus reliability and efficiency of the distance education systems Taşci [2014].

A Computer Based Test System (CBTS) is a form of assessment in which the computer is an integral part of question papers' delivery, response storage, marking of response or reporting of results from a test or exercise (Whillington 2000). It can be a multiple choice question based examination system that provides an easy to use environment for both Test Conductors and Students appearing for Examination. The main objective of a CBTS is to provide all the features that an Examination System must have, with the interfaces that do not scare its users (Baddi 2010).

An online examination system is an application that allows an institution conduct examination via the Internet (or intranet). Various companies, institutions

and organizations have opted for this method of conducting examinations, because it is quicker, easier and convenient. This system makes it easier for examiners to conduct exams and collate results. The application provides facility to conduct online examination anywhere and at any time. Today, most institutions are conducting their exams online to eliminate the bottlenecks associated with pen and paper type of examination. Technology has supported online examinations successfully for a number of years, and has progressively enhanced the process over the years to have room for more students and ensure a smoother online examination. However, one of the biggest challenges to online examination is cheating using technology.

E-exam simply is the process by which examinations are delivered, taken and scored electronically. It entails questions being deployed onto computer workstations (intranet and internet) and candidates answering the questions on to the computer. The process of writing exams is thus completely paperless. It is sometimes referred to as CBT (Computer-based testing) or CBA (Computer-Based Assessment).

E-examinations refer to the use of computers by candidates in a high-stakes supervised (proctored) assessment, generally simultaneously in a fixed time period. Adebayo and Abdulhamid's survey (2010) showed this definition has been widely accepted in private and public institutions of higher learning as well as in high schools by identifying common practices. Adebayo and Abdulhamid's survey indicate several examination bodies in Nigeria preferred e-examinations to manual examinations (in which students use "pen on paper"). Staff and students preferred e-examinations because of their flexibility, security, integrity, and ease of use.

Oduntan, Ojuawo and Odunntan (2015), define computer based tests as "assessment that are administered by computer in either stand-alone devices linked to the internet or world-wide web (www.), most of them using multiple choice questions." Abubakar and Adebayo (2014) opine that some major reasons for introducing CBT tests for UTME were to inhibit the rate of examination misconduct and also to speed up the release of results. The stance of this paper is that these reasons can be accepted as tangible if results produced using CBT forms are satisfactorily valid and reliable. Test validity is described as the extent to which a tests measures what it is designed to measure and nothing else.

Computer-based test is the use of computers to administer tests. Other terminologies used to describe Computer Based Test (CBT) include Computer Assisted Testing (CAT), Computerized Assessment, Computer Aided Assessment (CAA), Computer Based Assessment (CBA), Online Assessment, Web-Based Assessment, Technology Enhanced Assessment, Automation Assessment, and E-Assessment or Test or Examination (Mubashrah, Tariq and Shami, 2012; Obioma, Junaidu and Ajagun, 2013; Alabi et al., 2012). Computer Based Test means the candidate sits in front of a computer and the questions are presented on the computer monitor and the candidate submits the answers through the use of keyboard or mouse (Ogunlade et al., n.d). Automation of educational assessments, be it school-based assessment or other public examinations, can be described as the application of technology for the assessment of learning outcomes; using machines to perform those operations which hitherto was performed wholly or partly by teachers or employees (Obioma, et al., 2013).

Alabi et al. (2012) described computer based testing as a method of administering tests in which the responses are electronically recorded, assessed, or both. Computer Based Test (CBT) is grouped into linear/fixed CBT and adaptive CBT. Linear and fixed computer based test, most similarly to paper-based testing is the random method which can be used to administer a fixed set of items to provide a modest test security benefit. Alabi et al., (2012) defined a linear CBT as a full-length examination in which the computer selects different questions for individuals without considering their performance level. In CBT adaptive testing, when an examinee answers a question correctly, the next test item has a slightly higher level of difficulty. And the difficulty of the questions presented to the examinee continues to increase until a question is answered incorrectly. Then a slightly easier question is presented. Alabi et al. (2012) further explained that in a computer adaptive test, each test-taker receives questions that are at the level of difficulty for his or her ability. After each question is answered, the computer uses the answer and all previous answers to determine which question will be presented next. This means that different test takers, even in the same hall on the same day will receive different questions. With this approach; collusion, giraffing, and many other forms of examination malpractices will be eliminated using CBT technique.

The effectiveness of a computer based testing system depends largely on factors such as standardization, security, examination conditions, mode of administering the examination, cost and so on.

VII. METHODOLOGY

The study employs survey research design to generate data for the study. The use of survey data underscores the empirical nature of the study because it establishes the relationships that exist among the variables studied.

S/N	Statement	Category		Response Categories				Total	Mean score	Decision
			SA (5)	A (4)	UD (3)	D (2)	SD (1)			
1.	JAMB has adequate ICT Centres for electronic exams in Nigeria.	**Staff** **Students**	6 124	23 106	0 34	1 50	0 15	30 329	4.13 3.83	Agree Agree
2.	JAMB has up-to-date and easy to use ICT infrastructures to enhance electronic exams.	**Staff** **Students**	6 75	23 142	1 66	0 34	0 12	30 329	4.17 3.71	Agree Agree
3.	The computer Based Test centres have adequate seats and computers for each candidate making it less crowded and noisy.	**Staff** **Students**	7 86	18 157	3 25	2 44	0 17	30 329	4.00 3.76	Agree Agree
4.	The computer Based Test centres are conducive and secure for electronic examinations.	**Staff** **Students**	7 79	19 159	4 53	0 33	0 5	30 329	4.10 3.83	Agree Agree
5.	Locating CBT Centres is stressful and it affects performance in the exam.	**Staff** **Students**	3 101	5 119	8 47	9 44	5 18	30 329	2.73 3.73	Disagree Agree
	$Grand\ Mean = \frac{Staff}{Student} = \frac{3.83}{3.77} = \frac{Agree}{Agree}$									

The population of this study is made up of the entire Staff of JAMB which is 829 as at December 31st 2017 which cuts across all cadre and departments and admitted students for UTME from 2013-2017 (24,647) in the case of University of Abuja, 2015-2017 (5776) for College of Education Zuba and 2016-2017 (253) for Dorben Polytechnic, Bwari-Abuja. This is because FCT College of Education Zubaand Dorben Polytechnic, Bwari runs 3 and 2 years programme respectively.

The stratified sampling technique was adopted with a view to reflecting the characteristics of research population in JAMB (829), University of Abuja (24,647), FCT College of Education, Zuba (5,776) and Dorben Polytechnic, Bwari (253). Out of the total population of 31,505 a sample size of 381with the aid of 2006 Research Advisors Table for determining sample size was used at 95% confidence level.

The Statistical Package for Social Science (SPSS) was used to carry out the descriptive and inferential analysis of data. The data obtained from field survey were presented, analyzed, and interpreted through the use of frequency tables and simple percentage. This became necessary in order to give vivid description of all relevant variables in the survey conducted. The preference for this method was due to the pattern in which the questionnaires were framed such that nominal data can be easily converted into percentages.

IX. DATA PRESENTATION

Table One

Descriptive Analysis of JAMB ICT Infrastructures and

Electronic Examination

Source: Field Survey, 2018

Result interpretation

Table 1 above presents the item by item descriptive analysis of JAMB students and staff response to the statements on JAMB ICT Infrastructures Readiness for electronic examination. The mean score of the items for the two categories of respondents were all greater than the 5 – Likert scale measurement average i.e. 3.0, expect the response of items five, i.e. locating CBT Centres is stressful and it affects performance in the exam that was disagreed by the staff of JAMB with *(mean = 2.73)*

The result also showed that the grand mean rating of the JAMB staff *(mean = 3.83)* was higher than the grand mean rating of the students *(mean = 3.25)*. Since the grand means of both categories were greater than the 5 – Likert scale measurement average i.e. 3.0, it can be concluded that the students and staff agreed that to a high extent, the JAMB ICT infrastructures are adequate for electronic examination.

Test of Hypothesis

H_0: There is no significant relationship between adequacy of ICT infrastructures, and conduct of effective electronic examinations.

H_0: There is significant relationship between adequacy of ICT infrastructures, and conduct of effective electronic examinations

To examine the adequacy of ICT infrastructure and effective electronic examinations, the mean responses of pre and post ICT infrastructures effective electronic examination were subjected to a descriptive Statistics and independent sample t-test as presented in table 4.5.1 below.

VARIABLES

INDEPENDENT VARIABLE = Pre and Post migration to electronic Examination.

DEPENDENT VARIABLE = mean response on ICT infrastructures and Effective electronic examination

Table 2. T-Test result of the pre and post ICT infrastructures and electronic examination in JAMB

Table 2. T-Test result of the pre and post ICT infrastructures and electronic examination in JAMB

Periods	Total	Mean	Std. deviation	T- test	$t_{critical}$	d.f.	P –Value	95% Conf. Interval Upper	Lower
Pre Migration	42	3.3095	0.97501	1.9881	1.96	327	0.039	0.69976	0.1567
Post Migration	287	3.6516	1.1175						

An independent sample t-test was run to determine if there exit a significant between adequacy of ICT infrastructures, cyber-security and efficient electronic examinations. The test was found to be statistically significant because there were more post migration *(m = 3.6516, SD = 1.1175)* than pre migration, *(m = 3.3095, SD = 0.97501).* This difference was significant $t_{(327)} = 1.9881$, $P < 0.05$, the mean difference between pre and post migration 0.35.

From the result presented above, it can be seen that the calculated t-test of 1.9881 was slightly greater than the t-critical of 1.96 and the p – value of 0.039 was less than the level of significance = 0.05 at 327 degree of freedom (d.f.), the null hypothesis was rejected in favour of the alternative hypothesis. The conclusion reached based on the decision above is that; there is a significant difference between adequacy of ICT infrastructures, cyber- security and efficient electronic examinations, this implies that the respondents were of the opinion that ICT infrastructures and cyber- security had led to efficient electronic examinations.

X. DISCUSSION OF FINDINGS

This paper found out that there is high level of JAMB's cyber security before migration to electronic examinations. Results showed that JAMB staff disagreed with the statements in items 1-5 with χ=1.93, 2.03, 2.40, 2.07 and 2.03 while students agreed with all the statements. The responses here indicate that students disagreed with the security of JAMB ICT facilities for examinations while JAMB staff insist that JAMB has high level of Cyber-Security to protect its facilities from Cyber-attack that can compromise the quality of their examinations. The test of hypothesis found statistically significant between ICT and conduct of Effective electronic examination because there were more post migration *(m = 3.6516, SD = 1.1175)* than pre migration, *(m = 3.3095, SD = 0.97501).* This difference was significant $t_{(327)} = 1.9881$, $P < 0.05$, the mean difference between pre and post migration 0.35 and result thereof shows that the calculated t – test of 1.9881 was slightly greater than the t-critical of 1.96 and the p – value of 0.039 was less than the level of significance = 0.05 at 327 degree of freedom (d.f.), the null hypothesis was rejected that there is a significant difference between adequacy of ICT infrastructures, cyber- security and efficient electronic examinations which implies that ICT infrastructures and cyber- security had led to efficient electronic examinations.

This finding agrees with the study by Osang (2012) who found out that electronic examination is far better than the Paper Pencil Test due to real time delivery of results as well as reduced administrative cost. This finding also shows that the JAMB has been able to against all odds institute a valid system of examination that will stand the test of time.

XI. CONCLUSION

Even though there has been a dearth of ICT infrastructure in Nigeria, JAMB on her part has been able to significantly improve ICT in her domain for the conduct of her examination. This doe4s not rule out the general ICT challenges associated with poor electricity supply and internet services. What is needed is for JAMB to step up in expanding her network of centres across the nation and to seek more innovative methods for improved cyber security.

XII. RECOMMENDATIONS

Based on the findings of this study, the following recommendations were made:

(i) Computer education be made compulsory and e-learning fully entrenched in our educational institutions and particularly in Secondary Schools.

(ii) Creation of awareness/campaigns as well as rural advocacy by JAMB and other stakeholders to douses off the fear of CBT.

(iii) Creation of more CBT Centres across the country will reduce the hazards associated with travelling long distances to participate in the JAMB's entry examinations.

(iv) Government and NGOs should assist in the provision of basic ICT infrastructure such as computers to facilitate the education of the Secondary school students preparatory to their participation in JAMB CBT.

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